CEMENT
AND
CEMENT MANUFACTURE

INCORPORATING "PORTLAND CEMENT"

VOL. 2. NO. 8. AUGUST, 1929.

Retempered Concrete.

A CHANGE of attitude is taking place among cement manufacturers towards the question of the "killing" or "retempering" of cement. It has been the custom to assert that if cement is disturbed after the initial set has commenced the hardening is retarded and may be permanently impaired. The idea is embodied in many specifications for concrete which forbid the use of concrete that has commenced to set and require the concrete to be in its final position before setting commences. The risk of damage by disturbance of the initial set has, however, been tacitly ignored by all concrete floor layers, their practice being to perform the finishing operations to the surface of the floor after the initial set. Laboratory tests on a small scale have seldom supported the claim that cement is damaged by working through the initial set provided the mixture is maintained in a plastic condition, and although it is agreed that the proper way to lay concrete is to complete the operations before setting commences, cement experts have not felt themselves on very sure ground in predicting inevitable disaster from "killing" cement.

The publication by the Portland Cement Association (U.S.A.) of results of tests commenced in 1926 bearing upon this subject is therefore particularly welcome and should help to dispel the existing obscurity. The cement used for the investigation was slow setting, the initial set being three hours and the final set seven hours when gauged with $23\frac{1}{2}$ per cent. of water. The tests were made with mortar and concrete ranging from 3 : 1 to 7 : 1. All the tests were in compression and were on 6-in. by 12-in. cylinders. The most important conclusion to be drawn from the tests is that concrete can be remixed after standing for as long as six hours without any loss of strength provided it is protected from evaporation and is plastic and workable after remixing. If additional water needs to be added to restore plasticity, then there is a drop in strength related to the amount of additional water used. The tests prove that disturbance of the initial set is not disastrous provided the concrete is kept plastic by remixing. Any failures that can be definitely traced to the use of "killed" or retempered concrete are probably due to attempting to lay concrete which has reached the crumbling stage and cannot therefore be brought to a coherent mass, thus leading to a total failure; alternatively, if plasticity is restored by additional water, this leads to retarded hardening with permanent deficiency in strength.

Suggestions for a New Setting-Time Test.

(Contributed.)

THE amount of mixing necessary to overcome the characteristic of some modern cements known as "false set" varies with different samples. This is probably due to the amount of dehydrated gypsum present, as an experiment made by adding finely-ground gypsum, heated to a temperature of 280 deg. Fah. (a temperature occurring in some tubemills) to a cement giving a normal set with two minutes' mixing, brought about a "false set," and the greater the amount of this gypsum added the longer the mixing period necessary to eradicate the "false set."

It is possible that "false set" occurs in all gypsumised cements ground

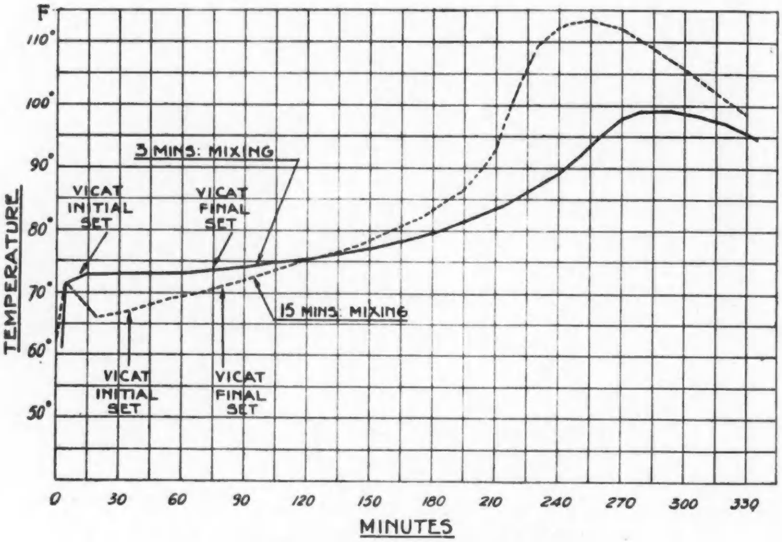


Fig. 1.—Temperature of Cement during Setting.

at high temperatures, and the reason it is not always detected is that it can be overcome by normal mixing in cases where the amount of dehydrated gypsum present is small. The characteristic may be due to the formation of $CaSO_4.\frac{1}{2}H_2O$ in the cement during grinding more than to the presence of anhydrite.

A cement with a very pronounced "false set," requiring 15 minutes' mixing to give a normal Vicat setting time, and ground under conditions which could have brought about the partial dehydration of practically all the gypsum contained in the cement, was examined for the heat evolved during setting. Two pastes were mixed for 3 minutes and 15 minutes respectively and the

rise in temperature during setting measured under identical conditions. The result is illustrated (Fig. 1), and an examination of the curves suggests that, by prolonged mixing, the initial heat generated in the paste is dissipated while the cement particles themselves are more thoroughly hydrated, resulting in a higher temperature being ultimately obtained during setting and leading to greater early strengths. Tensile tests of a 3 to 1 standard sand mortar of this cement subjected to 15 minutes' preliminary mixing gave 590 lbs. in 24 hours against 557 lbs. from the normally-mixed mortar. This result was confirmed by tests on other cements.

The publicity given to "false set" has been due to the advent of rapid-

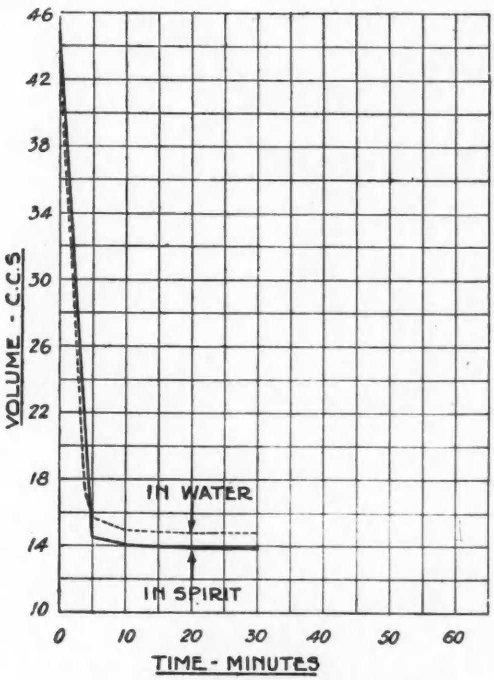


Fig. 2.—Settlement of Fine Sand in Water and Spirit.

hardening or modern cements, and it emphasises the fact that a true appreciation of the need of appropriate testing of these cements is not realised in any official specification issued. There is a risk of a cement requiring considerable mixing to pass the accepted Vicat test being rejected as quick setting, there being no provision in the Standard Specification for prolonged mixing, the period necessary to produce a plastic paste with just sufficient water for this purpose being deemed all that is required.

Experiments have been made to discover a setting-time test in which by means of a simple method, easy of standardisation, two operators could get the same results, a condition very uncertain with the Vicat needle test. During the course of these experiments it was found that each cement examined had a definite rate of settlement in liquid. A very thin grout was mixed by vigorously shaking 15 grams of cement in 40 c.cs. of water in a stoppered graduated tube for one minute, the cement being introduced into the tube first. The tube was then placed on a level surface free from vibration and a curve plotted showing the rate of settlement. The process was repeated using white spirit or turpentine substitute instead of water. Samples of inert materials (finely ground sand and emery) were separately treated in the same way. The tabulated list (Table I) shows some typical results, which are also illustrated graphically in Figs. 2, 3 and 4.

TABLE I.

Sample.	SPIRIT. Time taken to settle.	SPIRIT. Volume after settlement.	WATER. Time taken to settle.	WATER. Volume after settlement.	VICAT SET. Initial.	VICAT SET. Final.	Volume after settlement increase in water over that in spirit.
	mins.	c.cs.	mins.	c.cs.	mins.	mins.	Per cent.
Fine sand ...	20	14	20	14¾	—	—	6·2
Fine emery ...	20	10	20	10½	—	—	5·0
Cement 1 ...	100	13	45	17¼	90	210	32·7
„ 2 ...	65	12¾	3	39½	—	5	209·8
„ 3 ...	165	13½	55	17½	45	120	29·6
„ 4 ...	80	12¾	3	38½	—	5	201·9
„ 5 ...	100	13¼	40	16½	105	220	24·5
„ 6 ...	75	12¾	35	17½	30	110	37·2
„ 6 (after ignition)	65	12	16	19¼	—	—	60·4
Cement 7 ...	80	13	50	16½	115	230	26·9
„ 7 (after ignition)	85	12	21	18¾	—	—	56·2

The factors that influenced the settlement of cement in spirit are specific gravity and the size of the particles, and if only the same factors influenced the settlement of cement in water there should be a relation between the water and spirit curves; but obviously the action of water on cement has influenced the water curves, and more especially with cement known to be quick setting. In the case of the inert materials—sand and emery—the volume after settlement in water was 6.2 per cent. and 5 per cent. respectively greater than that in spirit, due to the different densities of the liquids, but the same time was taken to settle in both liquids. These figures are fairly close when the difference in the specific gravities of sand and emery is taken into account. In the case of cement the volume after settlement in water ranged from 24.5 per cent. to 209.8 per cent. greater than that in spirit, while there was no relation between the time occupied in settling in the two liquids. Differences in specific gravity between cements are negligible and variations in

particle-size could not account for the great observed differences in volume after settlement in water. In the case of ignited samples of cement (tending to accelerate setting) the volume of settlement in water was 60.4 per cent. and 56.2 per cent. greater than in spirit, compared with increases of 25 per cent. and 26.9 per cent. on the original samples.

It would seem, therefore, that the water curves of cement do not correspond to the behaviour of an inert substance similar to the cement in specific gravity and size of particles. The conclusion arrived at is that cement will continue to settle in a large excess of water until the setting action is sufficiently

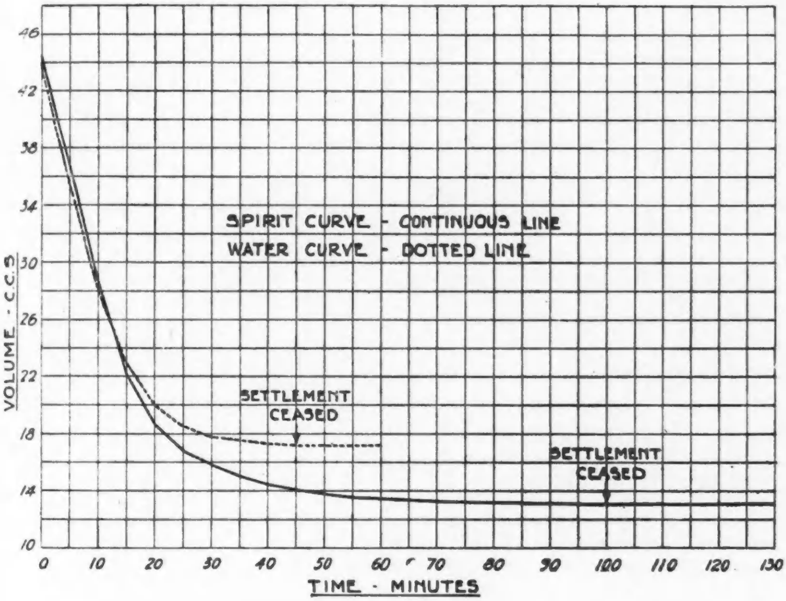


Fig. 3.—Rate of Settlement of Cement No. 1, Slow Setting.

pronounced to set up a coalescence between the particles, at which point settlement is arrested. This property could be made use of as an indication of setting expressed as the time taken for the cement to settle to a constant volume in water.

The setting action of cement is a slow and continuous one, and probably commences from the moment the water is added. The interpretation of "initial" set by the Vicat needle is that point where the cement paste has stiffened sufficiently to offer resistance to the needle. This resistance can be

influenced by outside factors such as the original consistency of the paste and the period of mixing.

The settlement test as an indication of the solidifying of the cement is not subject to such outside influences, and has the merit that the cement is itself the indicator. The test has the disadvantage of not being able to denote the final set, but when it is taken into consideration that there is no distinctive line between setting and hardening, the one being a continuation of the other, and the terms "initial" and "final" are only used to apply to the existing

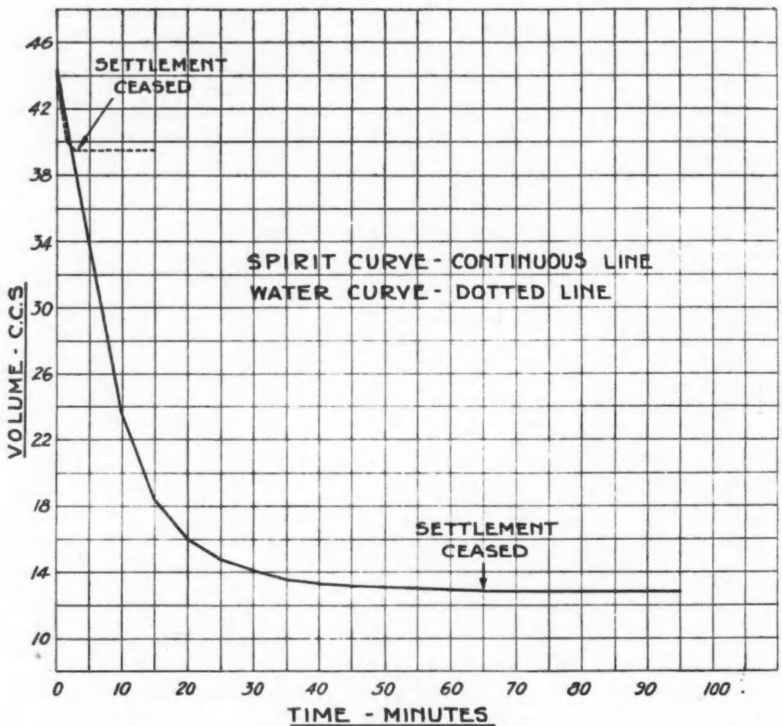


Fig. 4.—Rate of Settlement of Cement No. 2, Quick Setting.

method of ascertaining the setting-time value, the disadvantage can be said to have disappeared. The best test of a final set is the strength at 24 hours or even less. The settlement test would obviate any dispute as to the true setting time of any cement exhibiting a "false set," as cements with a marked "false set" with the ordinary method of testing proved to settle normally when subjected to the settlement test described above.

Filters for De-watering Slurry.

By A. C. DAVIS, M.I.Mech.E., M.Inst.C.E.I., F.C.S.

(Works Managing Director, Associated Portland Cement Manufacturers, Ltd.)

IN view of the economy in kiln fuel with the dry process of manufacture, which has been already described, the use of filters for partially de-watering raw materials prepared by the wet process has always appeared attractive. Even if the water in the slurry is as low as 35 per cent. and the moisture necessarily added to the dry raw material to avoid dust in a dry process kiln is, say, 7½ per cent., the difference represents nearly 0.7 of a ton more water to be evaporated per ton of clinker produced if the wet process of manufacture be adopted.

The application of filters has therefore sometimes been adopted in the manufacture of Portland cement with a view to reducing the loss represented by this evaporation. The method involves, however, a good many practical difficulties, which vary with the nature of the raw material used.

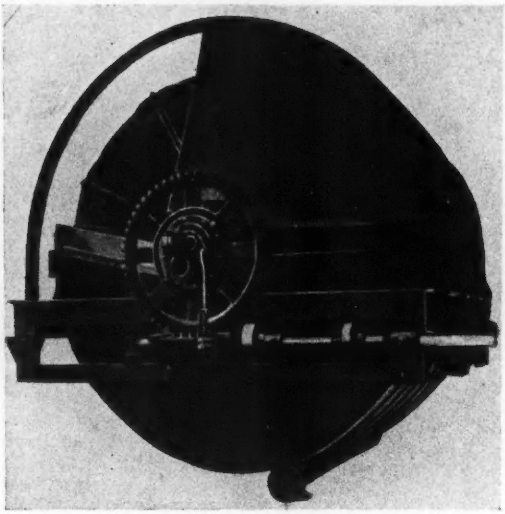
The application of the de-watering process is limited, and confined to raw materials particularly suitable to its practical success. It is only possible with continuous and automatic machines, and manufacturers have sought for automatic filters operating under pressure. What is known as "vacuum" filtration is, of course, pressure filtration, although the intensity is limited to the atmospheric pressure. There have been attempts made to obtain higher pressures than are obtainable with vacuum filters, but to date there has not been a simple, accessible, and foolproof unit for continuous filtering under high pressure offered on the market; fortunately, however, cement slurry can be handled at a low pressure.

The automatic and so-called "continuous" filters are in reality cyclic machines, each little unit in the machine operating through the successive cycles of filtration, de-watering, and discharging. They are unlike the cream separator, for instance, wherein milk continuously flows from one spout and cream from another. The cyclic functioning of the individual members in the filter, whether of the disc type or of the drum type, is a matter of design so as to proportion the requisite time for filtration, de-watering, and discharge.

The essential feature of an automatic filter, however, is its ability to continue filtering at its designed rate for indefinite periods. An apparatus which starts with a capacity of, say, 100, and after the first hour drops to 95, after the first day to 80, and after a week's operation to 50, is obviously unsuited to feed a rotary kiln, which depends for its efficiency on long continuous runs at uniform output under closely-controlled conditions. The problem must therefore be considered only in relation to the discharge of the de-watered solids at a constant pre-determined rate.

At first sight it would seem that the filter cloth is the principal filtering member, but this is not the case. The filter cloth is the screen which prevents the solids from passing into the drainage member with the liquid, and after

the first few grains of solid matter are deposited upon the cloth the filter cake itself becomes the filtering member. As the thickness of this cake deposited upon the cloth increases, naturally the resistance to the flow of liquid also increases. The rate of deposition of cake, though variable with different slurries, starts at a relatively high rate and rapidly falls off. Theoretically at least, therefore, the higher the speed of rotation of the automatic filter the greater the capacity per unit filter area. Practically, however, the speed of rotation is limited by the operation of discharge. Experience shows that it does not pay to operate a filter at a relatively high speed with an indifferent discharge. It is practical only to go at that speed at which all the cake



Partially-assembled Continuous Filter.

is completely discharged from the filtering cloth; further, the discharge of thin cake is more difficult than the discharge of thick and heavier cake.

The removal of the water from the cake so as to deliver a semi-dry product is a matter of time. The water removal in the first few seconds may be double that obtained in the next same number of seconds. There is therefore an economical limit in the time given for de-watering. But another point has also to be considered: the thick cake takes a longer time to de-water than thin cake, so that in practice the amount of water in the semi-dry cake must be balanced with the time required and the thickness of the cake produced. While therefore the ultimate object should be to obtain a cake with the least possible moisture, practical operation demands a degree of " dryness " that will result in a cake which will handle easily and positively into the kiln.

In practice the most important consideration in connection with the dewatering of slurry is its "filterability." This depends entirely on the physical nature of the raw materials. The amounts of argillaceous materials, organic matter, and other substances present in the colloidal state have a direct bearing on the rate of filtration, and determine whether or not the operation will be difficult. The fact that most of the clays used in England are colloidal, or at any rate partially so, constitutes the chief reason why slurry filters have not been adopted in this country up to the present.

While, therefore, advance in this direction has not yet resulted in the adoption of the system in England, technical improvements may still be possible which may secure adequate results. Present-day filters may be classified under two types, namely, the drum and the disc. In the former the filtering medium forms the surface of a cylinder which is divided internally into sections by longitudinal radial partitions. The spaces formed by these partitions are connected in turn to a vacuum pump and pressure pump; the former draws the water through the filter while the outside surface is in contact with the slurry, and the latter pushes the cake off into a chute or conveyor leading to the kiln.

The disc type consists of a series of thin circular compartments, the filtering surface forming the sides of the disc. This arrangement enables a much greater area of filtering surface to be accommodated in a given space. The action is generally similar to that of the drum type. The whole series of disc-shaped chambers is supported on a horizontal spindle slowly rotated by means of a worm gear. The shaft, which really takes the form of a tube, provides room for the connections to the vacuum and pressure pumps, and the operation is controlled by a series of valves which are in turn operated by the rotation of the filters. If necessary the process can be assisted by the application of pressure on the slurry side.

The operation is as follows: Consider a sector which is just submerging in the slurry contained in the tank. As its upper edge passes below the surface the full vacuum is applied to the sector. As it rotates through the tank a perfectly uniform and homogeneous cake is gradually built up on both surfaces as the filtrate is sucked through the cloth bag. Upon emerging from the opposite side of the tank with the cake fully formed, the corresponding filtrate channel in the centre shaft reaches the wash-water or drying port in the valve plug, to which a vacuum is also applied. This removes a great deal of the liquid or solution entrained in the cake-pores; the sector next passes into the washing zone. Here the entire cake surface is subjected to a finely-divided spray of wash-water, which is drawn through the cake thus displacing practically all of the liquid or solution still remaining in the interstices of the cake. After passing the washing zone, vacuum is still applied to the sector until it reaches the discharge position, and during this portion of the cycle the moisture is reduced as far as the nature of the cake permits. As rotation continues, low-pressure air is connected. This instantly inflates the filter-bag with air, and as it moves downward between the parallel edges of the cake discharger the cake is entirely removed from the cloth surface and drops vertically through the spaces between the individual pan-compartments on to a belt-conveyor or other device which may be employed for carrying it away.

The de-watering of slurry for the purpose of saving fuel and increasing output with rotary kiln burning on the wet process system of manufacturing Portland cement has not yet been adopted to a large-scale extent, and therefore comments must be reserved for the present upon the utility or practicability or economy of the development in the manufacture, although it is conceivable that in the future this may have a substantial effect in the equipment of cement plants.

Russian Developments in Cement Manufacture.

The German journal " Zement " contains the following notes on the Russian cement industry:

According to a detailed report of the people's delegate, W. W. Kujbyschew, issued at the March sitting of the Russian Supreme Economy Committee at Moscow, the approved industrial programme for the years 1929 to 1933 states that the following production of cement is envisaged by the Russian State Industrial " Planamtes " :—

1928	1929	1930	1931	1932	1933
		(in million casks)			
12	14	18	25	32	40

Up to the present time, Russian cement production has been far below the demand. This insufficient cement production forms an obstacle to the carrying out of the Russian programme of development in new industrial building activities, and it is hoped to remove this obstacle by means of improvements and extensions in all branches of the Russian cement industry.

During the 5-year period in question it is proposed to erect 27 new cement works with a yearly output of 26 million barrels, so that at the end of the period, the total of 55 works will be able to cope with a capacity of 40 million barrels—which is about three and one-half times the quantity produced in 1928.

As regards capital investments during these five years, 240 million roubles (about £25,925,000) are to be invested in the Russian cement industry—thus trebling the capital investments of 1928.

In this connection it is reported that a large cement factory is to be built at Jehtshurowo, near Moscow, with a capacity of 150,000 tons per annum. It is stated that construction will start next winter.

New Works for China.

A new cement plant has been proposed at Ying Tak, in the Kwantung Province, with an approximate capacity of 60,000 tons per annum.

Canada Cement Company.

The Canada Cement Company, Ltd., has purchased property fronting on the harbour at St. John's, New Brunswick, and a start on the construction of a cement works is to be made. This is the second plant to be established in the St. John's district, the Maritime Cement Company having already commenced a plant at Brookville, four miles to the east of St. John's.

Effect of Delay in Placing Concrete.

By J. E. WORSDALE, A.R.C.Sc., B.Sc.
(Chief Chemist, G. & T. Earle, Ltd.)

In an article published in the January number of "Cement and Cement Manufacture" entitled "The False Setting Time of Cement," results were given showing that a cement having a false quick-set of eight minutes, when used in making concrete produced better results after twenty minutes' mixing than if a period less than the initial setting time of the cement were employed. These results were quoted as proving that the false quick-set of a cement can be disregarded, and the writer, whilst not wishing to refute the statement, would draw attention to the fact that similar prolonged mixing over and beyond the normal setting-time of a cement gives similarly improved results, so that this must be considered as a property of concrete and not confined merely to that containing cement having a false set.

The writer had an opportunity of investigating this matter a little time ago. A batch of concrete, mixed 6 : 1 using river ballast 1 in. down and cement having a setting time of 70 minutes, was mixed with sufficient water to produce a plastic mix having a 2 in. slump. Test cubes were immediately moulded from some of this mixture, and the remainder of the concrete covered with sacks to prevent the evaporation of water. After two hours the concrete was thoroughly re-mixed without the addition of any further water, another slump test made, and further cubes filled, and the same procedure was repeated at four and six hours respectively. Table I shows the test results:

TABLE I.

Setting Time of Cement.	Period between Mixing and Filling Moulds.	COMPRESSION TESTS. (lbs. per sq. in.)			Slump. (inches.)
		3 days.	7 days.	28 days.	
70 mins. ...	Nil	1,080	2,890	4,665	2
,, ...	2 hours	1,240	2,920	4,820	½
,, ...	4 ,,	1,210	2,580	5,160	¼
,, ...	6 ,,	1,320	2,490	3,545	⅛

The point of particular interest in these results is the reduction in slump with the passing of time, for it is doubtful if under ordinary circumstances the 6-hour concrete would be mixed and used by the average workman without the addition of further water. The tests indicate that the setting time of cement as ordinarily reported does not constitute a time-limit in which concrete must be placed, but it must be borne in mind that in these tests no further water was added,

the concrete was very thoroughly mixed before being placed in the moulds, and adequate damp curing of the concrete was undertaken.

This behaviour of concrete is becoming well known and is the basis of the development of the pre-mixed concrete business which is developing rapidly in the United States. In some of the big road schemes it was found cheaper to deliver the aggregate and cement at one point and distribute mixed concrete from there than to have a number of separate mixing points; where the work extended over a considerable distance, delays of over an hour between mixing and placing were not infrequent. A series of tests resulted in conclusions similar to those recorded above, and the central mixing plant on big jobs in the United States has now become recognised practice.

The next development, and one which is increasing in favour, is the sale in towns of pre-mixed concrete. In this case concrete of the required proportions is mixed and transported in a metal tipping truck, and in certain instances an agitation device is included in the truck to prevent segregation of the concrete materials. Except with intelligent supervision and adequate precautions, however, delay in placing ready-mixed concrete will lead to disaster, and the cause of this can be illustrated by the results of a series of tests upon a sand-cement mixture under ordinary testing room conditions using the minimum amount of water to produce a workable mix.

TABLE II.

Setting Time of Cement.	Period between Mixing and Filling Moulds.	TEST RESULTS. (lbs. per sq. in.)			
		Sand Tensile.		Sand Compression.	
		7 days.	28 days.	7 days.	28 days.
60 mins.	Nil	470	550	5,100	7,120
,, ...	2 hours	310	360	4,420	5,100
,, ...	4 ,,	160	240	2,700	3,620

The difference in the effect of delay upon sand-cement mixtures and 6 : 1 concrete is explained by the amount of water originally present in the sand-cement mixture being only just sufficient to produce satisfactory consolidation in the moulds, the loss by evaporation being much more intense in the comparatively small amount of water present in this mixture. In practice, therefore, if conditions of rapid drying prevail, the delay in placing concrete would lead to trouble, so that the writer would advocate delayed placing only when large masses of concrete are under construction and where the mixing and placing are carried out under experienced supervision.

The Marking of Imported Portland Cement.

Merchandise Marks Act Enquiry.

On July 29 the Standing Committee (General Merchandise) appointed by the Board of Trade in accordance with the provisions of the Merchandise Marks Act, 1926, held an enquiry into an application made by the Institution of Cement Manufacturers for an Order in Council under Part II of the Act to provide that imported Portland cement must bear an indication of its foreign origin. The application was opposed by the National Federation of Building Trade Employers.

The Committee consists of Sir Hubert Llewellyn Smith, G.C.B. (chairman), the Rt. Hon. G. N. Barnes, and Mr. F. R. Davenport. The applicants were represented by Mr. Roland Oliver, K.C., and Mr. Rowland Thomas, and the opponents by Mr. Malcolm Hilbery, K.C., and Mr. F. J. Rimmer.

The applicants asked that the sacks or other containers used for imported Portland cement should bear the marks of origin at the time of importation into the United Kingdom as well as at the time of sale or offer for sale both wholesale and retail. The Institution comprised 33 firms, and claimed to represent over 98 per cent. of the manufacturers of cement, who produced over 95 per cent. of the Portland cement manufactured in the United Kingdom. All these firms, and the Cement Makers' Federation, the National Joint Industrial Council for the Cement Manufacturing Industry, and the National Federation of Builders' Merchants, supported the application.

The firms in question claimed to provide employment for about 15,000 workpeople, and to be well able to supply the whole of the Portland cement required in the United Kingdom. The amount of foreign Portland cement used in this country, said Mr. Oliver, represented a very small proportion of the amount provided by the British manufacturers.

In some cases, it was admitted, the packages containing foreign Portland cement bore an indication of origin, but in others the cement was packed in plain sacks or casks, and it was impossible for a purchaser even though he were an expert, to distinguish between British and foreign cement by visual examination. It might be done by analysis, but it was very difficult. Some of the foreign cement was "artificial," in the sense that the raw material was scientifically mixed, but there was also the "natural" cement, the raw material for which was already mixed by nature itself. This latter type was not produced by the British manufacturers. One could not distinguish between "artificial" and "natural" cements except by analysis.

It was proposed that the indications of origin should be stencilled or otherwise painted conspicuously on every jute or paper sack, cask, or other package, and it was urged that this method of marking was practicable, was not injurious to the packages or their contents, was of negligible expense, and was the method already adopted by those firms who already applied marks to the packages containing their products. The quantity of Portland cement imported in 1926 was 317,532 tons; in 1927, 397,754; and in 1928, 262,307 tons.

The opponents—the National Federation of Building Trade Employers—expressed the belief that its members purchased a far larger amount of Portland cement than any other body of persons. It was suggested that the tests prescribed by the British Standard Specification could be satisfied by Portland cement of foreign as well as of British manufacture. They expressed the view that the marking of imported Portland cement, as proposed, would arouse in the minds of owners of buildings and public works a presumption of inferiority of strength and quality which would be quite contrary to fact, and it was suggested that one of the purposes of the application was to give rise to such a presumption of inferiority and so to discourage the use of foreign Portland cement in the United Kingdom.

Commenting on this statement, Mr. Oliver said that some of the foreign Portland cement was inferior, while some of it was "natural" cement, the strength of which was variable.

It was also stated by the respondents that, though their members used British Port-

land cement in very much larger quantities than the foreign, they were apprehensive that any prevention or discouragement of the use of the foreign cement might result in an increase of the prices of British cement, and in the conditions of supply being less favourable to them. Unless there were free foreign competition the prices and conditions of British supply might become very adverse to the building trade. The free use of foreign Portland cement was the only safeguard against the imposition of monopoly prices for British cement. There was also apprehension that the effect of a marking Order might be to prevent the use of foreign Portland cement when the British manufacturers were unable to supply, so that the builders might incur penalties as the result of delay, or might be required to pay excessive prices for British Portland cement in order to avoid such penalties.

Mr. Oliver's reply was that the British manufacturers of cement were employing only about 66 per cent. of the capacity of their works.

Finally, the respondents urged that Portland cement was purchased usually in large consignments by people in the trade who were well aware of its origin, so that the marking of imported Portland cement was unnecessary and undesirable.

Mr. E. C. CHARLETON (Director, British Portland Cement Manufacturers, Ltd.), gave evidence in support of the application. The worst of the British Portland cement, he said, was made to comply with the minimum requirements of the British Standard Specification, but most of it was much above that standard. A guarantee of its quality was given with consignments of cement.

Referring to "natural" Portland cement, which was made in Belgium from raw material found in the ground already mixed, he said the natural mixing was not reliable, and the cement was not regarded as reliable.

The CHAIRMAN asked if a purchaser could distinguish between "natural" Portland cement and the artificial Portland cement produced in this country.—Mr. CHARLETON replied that it could be distinguished by analysis, but not otherwise; it would in some cases be very difficult to distinguish one from the other even by analysis.

The Chairman asked for an assurance that, in the event of a marking Order being made and a prosecution arising from alleged evasion of it, the foreign cement could be distinguished from the British cement.

Mr. CHARLETON replied that some of the "artificial" cement imported was of very good quality. In some cases the bags containing imported Portland cement were already marked with an indication of the origin of the cement. That being so, he disagreed with the respondents' suggestion that an indication of origin would prejudice sales.

Samples of bags in which foreign Portland cement had been imported were then exhibited to the Committee, some of them being marked and some unmarked. Nobody, said Mr. Charleton, could tell by visual examination of the bags whether they had contained foreign or British Portland cement. One of them was marked with the letters "A.P.C.," which, it was stated, meant "Artificial Portland Cement." Such marking, it was pointed out, might lead to confusion, because it might be thought that the letters meant "Associated Portland Cement" and that the cement was made by the Associated Portland Cement Manufacturers, Ltd. Advertisements offering foreign Portland cement, but which contained no indication that the cement was foreign, were also exhibited. Witness said he did not allege that these represented deliberate attempts to deceive the buyers, but the fact remained that there was no indication of origin.

In cross-examination, Mr. CHARLETON suggested that buyers would probably presume from such advertisements that the cement advertised was British, but Mr. HILBERY emphasised that the advertisements contained nothing to suggest that the cement was of British origin.

Arising out of questions put by Mr. Hilbery to support his contention that cement was bought usually in large quantities by contractors or distributors, who were well aware of the origin of the cement they were buying, the Chairman asked to whom the British manufacturers sold.—Mr. CHARLETON replied that they sold direct to builders or to builders' merchants. The manufacturers associated with the application produced for consumption in this country and for export approximately 4,000,000 tons in each of the years 1926, 1927, and 1928, and he believed it was all sold under brand names.

The CHAIRMAN asked why, in view of the statement that many foreign brands were

already on the market in this country and were known by the buyers to be foreign, it was now suggested by the respondents that marking would drive foreign cements off the British market.

Mr. HILBERY expressed his view that it was the hope of the applicants that the sales of foreign cements would be prejudiced if sacks marked with an indication of origin were exposed on buildings. For instance, building owners might object to foreign-marked sacks of cement lying about their building sites.

Another point raised by the Chairman was that, if it were made obligatory for the sacks to be marked at the time of importation, it would be necessary for the Customs officials at the ports to examine them. He asked, therefore, whether non-technical Customs officials could be expected to distinguish between Portland and other cements.—Witness said he could not, neither could he distinguish between "artificial" and "natural" Portland cements.

Mr. W. R. BARLOW (Secretary of the Cement Marketing Co., Ltd., the selling organisation of the Associated Portland Cement Manufacturers, Ltd., and the British Portland Cement Manufacturers, Ltd.), in evidence, said that the importation of Roman cement, which could not be understood by any purchasers of cement as coming within the description of Portland cement, was negligible.

It was pointed out by the Chairman that whereas the applicants had stated that the importation of foreign Portland cement in 1928 had amounted to 262,307 tons, the Board of Trade figures showed that the amount of calcareous cement imported for building and engineering purposes in that year was 276,000 tons.—Mr. BARLOW suggested that the difference represented the quantity of white Portland cement, which was imported from the United States and bore an indication of origin. When the application was lodged there was probably no white Portland cement made in this country, and it was only within the last two or three months that it had been made here successfully.

The Chairman then asked whether it was desired that white cement should be included in the Marking Order if it were made, and Mr. Oliver asked that it should be.

In the course of cross-examination an argument arose as to whether "natural" cement would be classified as "Roman" or as "Portland" cement. Mr. Hilbery suggested that it would be included under the generic term "Roman," but witness had no hesitation in saying that it was known as being included within the generic term "Portland" cement.

Mr. HILBERY asked what the public would gain by the proposed marking, if they could get foreign cement of a quality as good as that of the British and at a lower price.

Mr. BARLOW did not agree that all the foreign cement was of the same quality as the British. The British buyer would be protected by marking because he would be given the opportunity of knowing the source of his purchases.

Mr. H. M. BRABANT (secretary of the Institution of Cement Manufacturers, and the Joint Industrial Council for the Cement Industry), gave evidence in response to a question by the Chairman as to the justification for the applicants' statement that the Joint Industrial Council supported the application. He said that this matter had not been discussed formally at a meeting of the Council, but it was within his knowledge that the Council supported it, and that the representatives of employers and employees on the Council wished to help the home manufacturers as much as possible to combat foreign competition. With regard to the National Federation of Builders' Merchants, witness produced a letter stating that the Executive Committee of that body had passed a resolution supporting the application.

This concluded the evidence on behalf of the applicants.

Mr. I. E. JONES (assistant secretary, National Federation of Building Trade Employers), gave evidence in opposition to the application, and said the view of the Federation was that there was no necessity for a Marking Order. The builder was bound to order cement to comply with the British Standard Specification. He ordered it direct from the manufacturers or importers, or, if the quantities were small, from merchants, but there was always a supervising architect or engineer whose duty it was to ensure on behalf of the building owners that the cement was of a suitable standard. British brands were well known, so that he could not imagine that a Mark-

ing Order could protect anyone. Builders to-day did not buy foreign cement in the belief that it was British. The "natural" and "artificial" cements could be distinguished by sieving and setting tests. There were discrepancies in the fineness and setting times of natural cements, and they would not all meet the requirements of the British Standard Specification.

In reply to the Chairman, he said the amount of business done in small quantities sold to individual purchasers outside the trade was negligible as compared with the amount bought by members of the trade. There was an increasing tendency for architects to specify that the cement used should be of British manufacture, but nobody who used cement for public works or buildings of any size, right down to the smallest, was likely to be deceived as to the origin of the cement in the absence of a mark.

In cross-examination, Mr. OLIVER expressed concern for the large number of small builders who were operating in small villages, and who used large quantities of cement. Apparently they were supposed to know which were British, but in fact there were many British brands, and he urged that cements must be branded as being British or foreign in order that one could be sure of their origin.—Mr. JONES replied that if a cement did not bear an indication of British origin the presumption was that it was foreign.

Mr. OLIVER asked if witness suggested that the branding of the words "Made in Belgium" had had the effect of decreasing the sales of Belgian cements which were already marked voluntarily.—Mr. JONES said he did not.

Mr. OLIVER asked why it was suggested, therefore, that such marking would decrease sales in the future.—Mr. JONES said the point was that it was intended to create prejudice, and he apprehended that marking of cements not marked hitherto would tend to increase prejudice.

In reply to further questions, he said nobody who knew his job would be deceived in the absence of marking, but Mr. OLIVER reiterated that he had in mind the protection of the small local builders in the villages.

It was pointed out by Counsel that foreign cement was cheaper than British, and witness agreed with him that it would not be honest to sell foreign cement at the same price as British. Counsel pointed out, however, that in the absence of marking, opportunities were being given for such dishonesty to be practised.

With regard to the suggestion that "natural" and "artificial" Portland cement could be distinguished by a sieving test, Mr. OLIVER said that "natural" cement could be ground just as fine as any other Portland cement.

This concluded the evidence.

Mr. HILBERY, addressing the Committee on behalf of the respondents, said there was no evidence to show that the marking of imported Portland cement was necessary, and emphasised that cement was a commodity which was purchased by members of the trade who were aware of its origin and was not purchased by members of the public "over the counter." The small builder knew that the cement he bought was guaranteed to be up to specification, and could have it tested if he wished; if inferior cement were marketed it would soon be discovered and disclosed by the British manufacturers.

The CHAIRMAN pointed out that a Marking Order was not intended to be a remedy against falsely representing a foreign cement to comply with the British Standard Specification. The remedy against that was quite a different one.

In the course of subsequent discussion as to whether Portland cement could be distinguished by Customs officials from "Roman" and other types, Mr. OLIVER pointed out that Roman cement was brown in colour, whereas Portland cement was grey.

Mr. HILBERY, dealing with the suggestion that the selling of foreign cement at the same price as the British was dishonest, pointed out that cement was sold to a standard. There were ruling prices for cements of a certain standard, and he saw nothing ethically wrong in selling a foreign cement at the same price as the British so long as it was up to that standard.

Mr. OLIVER said it was obvious that the marking of the foreign cement was objected to in order that it could be sold at the same price as the British. The respondents had suggested that the marking of foreign cement would prevent its sale and would place the builders in the hands of the monopolists who would increase their

prices. Could that argument be demolished more effectively by pointing out that many of the foreign brands were already marked?

Giving his reasons for asking that foreign cements should bear indications of origin at the time of importation, Mr. Oliver said it was easier and cheaper to mark the bags before packing than afterwards, and further, owing to the difficulty of distinguishing between British and foreign cements in the absence of marking, it would be difficult to detect evasions of a Marking Order after the cement had been admitted into this country.

The Chairman pointed out that if an Order were made to provide that the bags must bear the marks at the time of sale or exposure for sale in this country, and not necessarily at the time of importation, the bags could still be marked before importation if the manufacturers or importers chose to do so.

Questions were asked by the Chairman as to the proportion of foreign cement which was bought by large contractors for their own use. Mr. Oliver said that the bulk of the foreign cement imported was used by small users, but this view was contested by the respondents, who held that a large proportion was imported direct by large contractors for their own use, and not for resale.

This concluded the enquiry, and the Committee will report their recommendations to the Board of Trade in due course.

New Turkish Company.

The Societe Financiere des Ciments (Cimfina) has formed a Turkish company known as the "Societe Anonyme Turque des Ciments d'Anatolie," with a capital of £T.2,000,000, of which 90 per cent. has been subscribed by the Belgian company and 10 per cent. by the firm of F. L. Smidth, of Copenhagen. The principal activities of the company will be in connection with the production of cement, but it is intended also to produce other constructional material. The factory will be erected at Kartal (an Asiatic suburb of Constantinople on the shores of the Marmara) in the neighbourhood of suitable quarries. To commence with the annual production will be 60,000 tons of artificial Portland cement.

New German Cement Plant.

"Portland Zement Werke, Basbeck," is the name of a new company, with a capital of RM.2,725,000 (£137,500), formed at Basbeck, near the Hemmor Zement Company's plant. The promoters include engineers connected with the German National Underground Railways, who are at the moment using very large quantities of cement. The plant is to have a capacity of 200 tons per day, increasing to 400 tons per day should demand warrant. Production is to commence during May, 1930.

New Cement Company in Morocco.

The Societe Poliet et Chausson-Maroc has been promoted by the Etablissements Poliet et Chausson, of France, to manufacture cement and plaster at Casablanca. The capital of the company is £160,000, and we understand that the plant is already in course of construction. Although there is already a cement plant at Casablanca, the demand for cement in Morocco has been steadily increasing. Imports into French Morocco last year were 84,624 tons against 54,000 tons for the preceding year.

"False Set" of Portland Cement.

A correspondent writes :—

SIR,—The frequent references to the so-called " false set " of cement in your journal point to the great interest that exists in this peculiar phenomenon. Probably many of us have our own notions on the matter, and by contributing them to the common stock we may hope to eventually reach a solution.

Your correspondent " C.E.H. " suggests that dehydration of gypsum perhaps has some bearing on this point, and this theory has many supporters. But there are other considerations, and I should like to suggest one that I think goes a long way towards explaining the trouble, and give a few observed facts in support of it.

Surface tension of the fine particles in a rapid-hardening Portland cement makes them difficult to wet, and in gauging there is a possibility of the " balling up " of bundles of tiny particles which become wetted on the outside of the bundle only and give a plastic mortar; but after a few minutes the water percolates into the interior of the bundles with an apparent stiffening of the pat which is mistaken for an initial set.

A certain cement made from a hard gritty clinker never shows " false set " when ground to a fineness of 0.5 to 0.8 per cent. on a 180 sieve with a flour content of 78 per cent. When gauging, the cement is difficult to work up, and cannot be placed into the mould in less than about four minutes, and after a short time excess water leaks from the bottom of the mould though only 22 per cent. be used. It can be well imagined that this hard clinker when ground to such a fineness shows plenty of heat in the mill.

Another cement, if ground from fresh warm clinker, never shows " false set," but if a proportion of damp stored clinker be used this soft clinker flakes badly in the mill and the resulting cement shows " false set." The mill is quite as hot in one case as in the other, so that there is the same chance of dehydration of the gypsum, and also the cement showing false set has more than sufficient water (from the damp clinker) to provide for all that the gypsum may require.

That this so-called " false set " is not a set at all can be demonstrated by rapping the mould vigorously on the bench after the needle has registered an initial set. It then becomes " unset " and quite plastic, and often excess of water appears on the surface. The pat then proceeds to register a normal setting-time corresponding to that obtained after a more prolonged gauging. The pat can also be knocked out of the mould and regauged with the same result. It may be said that the initial set has been disturbed and the slow setting-time recorded is abnormal, but you published some figures recently which disproved this. Is there really any such thing as an initial set to disturb? Surely cement commences to set when it first comes into contact with water.

(*Continued on page* 231.)

If " false set " be due to dehydration of gypsum, why did it never show on the coarse cements of a few years ago, many of which left the mill quite as hot as do modern rapid-hardening cements which show " false set."

I would like to suggest for discussion that :—

(1) " False set " is due only to insufficient gauging, that is, every particle of the cement has not been brought into contact with the gauging water.

(2) " False set " occurs chiefly when the clinker is of a soft nature and tends to clog and flake in the mill, a tendency which is aggravated by high temperature, whereas with hard gritty clinker high temperature does not produce " false set."

When the number of particles in a weighed amount of rapid-hardening cement is compared with the number of particles in the same weight of a cement ground to, say, 16 per cent. on a 180 sieve it must be obvious that more gauging is likely to be required to wet all these particles using the same amount of water, and if it is found that such a cement works up as easily and quickly as did the coarse one there is at least a ground for suspicion that there may be places to which the water has not penetrated.

W.T.W.

" The Highest Cement Plant in the World."

The Allis-Chalmers Manufacturing Company, of Milwaukee, Wis., U.S.A., write: " In your April issue there is an article entitled ' The Highest Cement Plant in the World,' referring to the plant of the Bolivian Portland Cement Company. This article refers to the troubles encountered in attempting to manufacture Portland cement of proper quality. Subsequent to the time this article was written, the Cowham Engineering Company, of Chicago, Illinois, has sent an experienced operator to Bolivia, who made a few slight changes around the plant, and since that time a high-grade Portland cement has been produced."

Trade Notices.

Mr. Alan D. Maclean, B.Sc., A.M.I.Mech.E., A.M.I.E.E., has resigned his position as chief assistant engineer of the Yorkshire Electric Power Co. in order to take up the position of general sales manager to International Combustion, Ltd., Africa House, Kingsway, London, W.C.

We have received from Messrs. International Combustion, Ltd., of 11, Southampton Row, London, W.C.1, a series of pamphlets " issued in the interest of power conservation, improved grinding, and increased profits," dealing with the " Hum-mer " electric screen, for which the company holds the sole selling and manufacturing licence in Great Britain.

Investigation of the Effect of Retarders.

As the result of experimental work in which four samples of anhydrite, one of gypsum and one of plaster of Paris were tested with cement clinkers, Mr. E. E. Berger, a United States investigator, has arrived at the following conclusions;

(1) Although it is sometimes possible to produce a normal setting cement with pure anhydrite, a larger percentage of SO_3 is required with it than with gypsum or plaster of Paris. Two per cent. of SO_3 as straight anhydrite may be below the minimum required if the clinker is difficult to retard.

(2) When an equivalent mixture of anhydrite and plaster of Paris is used as a retarder, a smaller percentage of SO_3 is required than with straight anhydrite; mixed retarders should be suitable except where the maximum amount of SO_3 as gypsum is required for proper retardation.

(3) The plasticity of cement retarded with anhydrite is lower than of that retarded with gypsum or plaster of Paris, but the plasticity of cement containing mixed retarders is equivalent to that of cement retarded with gypsum or plaster of Paris alone.

(4) The strength of cement retarded with plaster of Paris is generally higher than of that retarded with anhydrite or gypsum alone, but cement containing an equivalent mixture of anhydrite and plaster of Paris is as strong as cement containing any other form of calcium sulphate.

(5) There was practically no difference in the results obtained by the different samples of natural anhydrite. However, the fineness of the anhydrite was of considerable importance, particularly as regards its effect upon the plasticity of the cement.

(6) Better and more uniform results were obtained by grinding the retarder with the clinker than could be obtained by grinding each separately. Consequently this method is the better to follow in laboratory tests.

(7) An analysis of the solution obtained from pats of neat cement revealed the fact that with gypsum, at least, there is less SO_3 in solution when the cement is ground in a mill of 200-lb. capacity than when the gypsum and clinker are ground together in the large tube mill. This indicates that further modification in laboratory testing is necessary if the results are to be comparable with mill conditions.

(8) A further study of solution from cement retarded with the different forms of calcium sulphate showed that the amount of SO_3 in the cement solution was directly related to the solubility of the retarder used. Thus the much higher SO_3 content in the cement solution retarded with plaster gives some indication as to why it is possible to add an excess of this form of retarder.

(9) A study of the pH of the cement solution shows that there is a direct relation between the alkalinity and the SO_3 content of the solution. Whether the pH is the controlling or only an accompanying factor in the setting process of Portland cement can only be determined by further experiment.

(10) Since more or less indefinite and inconclusive results are being obtained by the present method of studying the action of cement retarders, it is desirable, if possible, to substitute for this method one which will give more definite information concerning the action of each form of retarder.

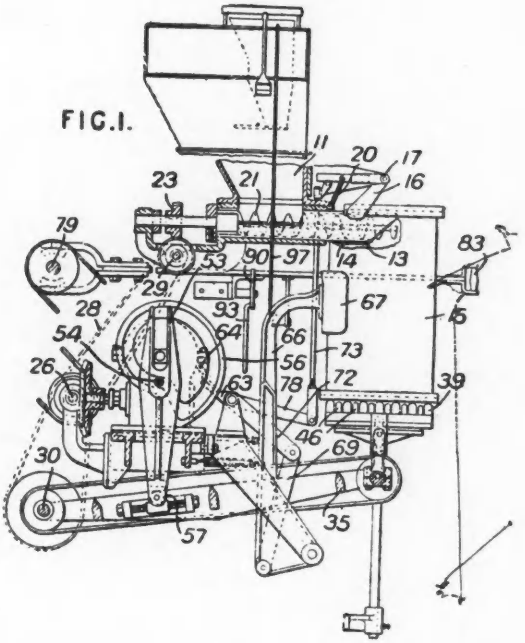
Recent Patents Relating to Cement.

Filling bags. BATES VALVE BAG CORPORATION, 8200, South Chicago Avenue, Chicago, U.S.A.—(Assignees of Cornell, J. E.; 5116, Blackstone Avenue, and Verwys, J.; 8200, South Chicago Avenue, both in Chicago, U.S.A.) January 31st, 1928, No. 13447/29.

In an apparatus for filling valve bags, the bag (15) is placed with its valve opening (14) on the filling tube (13) of a hopper (11), and with its lower end not quite reaching to cross-bars (39, 46) mounted on a jigger frame (35). A clutch handle (83) is operated to place the main driving shaft (79) in gear with a countershaft (26), from which a propeller worm (21) is rotated, by gearing (28, 29, 23), to deliver a charge into the bag. At the same time, the frame (35) is raised to support the bag, the effective length of which is shortened by bulging due to the charge. The frame (35) is pivoted at (30), and is raised by the action of a cam (56) on a roller (54) in the forked head of a link (53) adjustably pivoted at (57). During the filling operation, the bag is held on the nozzle by a clamp (16), pivoted at (17), and held down in position by a spring (20).

When the bag is full, the cam (56) has completed a revolution, and a lug (64) thereon depresses an arm (63) and operates links (78, 73) to lift the clamp from the bag, and links (72, 69, 66) to cause an ejector (67) to remove the bag from the machine. The jigging frame is lowered by the cam (56), and an extension thereon operates a rod (93) to withdraw a catch (90) and allow the clutch handle to return to neutral under the influence of leaf springs, thus stopping the rotation of shaft (26), and consequently that of the worm (21). The charge delivery device is actuated by the engagement of the clutch handle with a rod (93).

FIG. 1.



Two filling nozzles may be arranged side by side to be actuated alternately, a gate in the charge delivery device being turned to one side or the other by the clutch (83). In a modified form, a number of filling devices are mounted on a rotary spider, and are adapted to arrive in turn beneath one or more charge delivery devices. The valve aperture of the filled bag may be closed by paste.

Cement Compositions. METHERELL, A., 40, Sun Life Building, Hamilton, Ontario, Canada.—(Assignees of Barnhart, G. E.; 221, Mercer Avenue, New Brighton, Pennsylvania, and Pfaff, H. E.; 1001, Hollywood Avenue, Warren, Ohio, both in U.S.A.) April 17th, 1929, No. 11978. Not yet accepted. Abridged as open to inspection under Section 91 of the Acts. [Class 22.]

A waterproofing and glaze forming composition for adding to the gauging water of cement mortars and concretes comprises a mixture of metallic sulphates or other salts. The preferred mixture comprises equal volumes of aluminium, magnesium, sodium and potassium sulphates. Various changes may be made in this mixture; for instance, some of the sulphates may be omitted or replaced by the sulphates of other metals such as zinc or iron, or by other salts such as potassium or magnesium chloride or sodium silicate. Calcium chloride is not used. Examples of these modified mixtures are (*a*) two parts of sodium sulphate, two parts of zinc sulphate, four parts of potassium chloride and one part of magnesium chloride, and (*b*) equal parts of sodium silicate, aluminium sulphate, potassium chloride, and magnesium sulphate.

Recent Patent Applications.

307,970. K. CHRISTENSEN.—Method of packing cement.

307,763. A. C. DAVIS.—Manufacture of cement.

306,613. A. V. JENSEN.—Rotary cement-burning kilns.

288,192. O. LELLEP.—Process of and apparatus for burning cement in a rotary kiln.

298,943. I. G. FARBENINDUSTRIE AKT.-GES.—Process for improving the hydraulic properties of Portland cement.

INDEX TO ADVERTISERS.

(*CLASSIFIED INDEX ON PAGE* II.)